RAINFALL AND FLOOD AT FORT WORTH, TEXAS.

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[Weather Bureau, Fort Worth, Tex., May 25, 1922.]

During the night of April 24–25, 1922, Fort Worth, Tex., was visited by the severest electrical storm it ever experienced, accompanied by rainfall unprecedented in the history of the local United States Weather Bureau or in the memory of oldest inhabitants, which resulted in flood waters of the Trinity River reaching the highest stage of record.

The weather chart of the morning of the 24th showed the primary low-pressure area overlying the southwest, with Phoenix, Ariz., as the center of depression, reduced barometer reading 29.76 inches at time of observation on the 24th, and 29.70 at the morning observation date of the 25th. High pressure prevailed in the northern Rocky Mountain regions and also over the territory east of the Mississippi River, permitting the outflowing surface currents of each high-pressure area to flow into this primary low-pressure area over the southwest.

This relation of the two HIGHS and the primary LOW remained practically unchanged for fully 48 hours, and as long as these relations were maintained and the barometric pressure at Fort Worth continued to increase, heavy to torrential rains persisted at Fort Worth.

All day of April 24 the sky was wholly overcast with heavy alto-stratus clouds having quite rapid movement from southerly directions, primarily from the south, until about sundown, at which time cloud movement seemed suspended except in lowering, sagging, and bellying, vast smoky-looking detachments bagging downward at various points in the northwest, making one think of huge conical stalactites suspended from a darker-colored ceiling of cloud surface. These detachments would slowly dissolve in lowering, disappearing almost suddenly as if swallowed up by some stratum of differing temperature.

No marked commotion was detected in the clouds, yet a sharp barometric depression resulted at 4:30 p. m., attended by a thunderstorm, accompanied by wind from the southeast at 4:39 p. m., attaining 46 miles an hour for a period of five minutes. With the passing of the thunderstorm the wind abated rapidly, barometric pressure increased, rising almost to the level that obtained prior to the beginning of the thunderstorm, reduced pressure being close to 29.92 inches. Wind velocities now varied from light air to light breeze, though abruptly shifting from the southeast to the northwest, back through the west, again to the southwest, and finally to the south, continuing in the south from 9 p. m. through midnight, velocity never reaching above 8 miles an hour until midnight, after which hour the wind blew from the east at moderate breeze velocity until 4 a. m. of the 25th.

By 9 p. m. of the 24th the wind had died down to 4 miles an hour from the south. The stillness was oppressive and darkness so dense as to be inexpressible. At 9 p. m. lightning darted hither and thither in the northwest and northeast, and continued until 9:39 p. m., then there burst forth deafening peals and crashes of thunder, accompanied by sheet lightning that made the heavens seem on fire, while forked streamers of electrical discharges radiated from countless points. The crackle of the electricity on near-by wires was continuous and suggestive of a highly surcharged condition of the atmosphere. The close-range thunder seemed to cause the earth to tremble and dwellings to rock, the rapid crashes and reverberations resulting in a continuous roar, scarcely abating from 9:39 p. m. of the 24th until 1 a. m. of the 25th.

Rain began falling at 9:06 p. m. of the 24th, large drops at first, gradually thickening, reaching an excessive rate of fall by 11:39 p. m., and continuing until 1 a. m. the 25th, as above stated.

TABLE 1.—*Accumulated depths during excessive rate, for consecutive periods of time.*

5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
0.06	0.14	0.31	0.54	0.70	0.75	0.89	1.28	1.63	1.89	2.43	3.07	3.62	4.07

From 10:19 p. m. of the 24th to 7 a. m. of the 25th there fell 7.50 inches of rain. Between 12 midnight and 1 a. m. there was a record of 2.50 inches for the hour; 1.02 inches fell in 15 minutes; 1.74 inches in 30 minutes; the maximum fall in 2 hours was 4.06 inches. The 24-hour precipitation amounted to 8.81 inches, actually occurring within 14 hours and 22 minutes.

The resulting flood.—Fort Worth, Tex., is located a short distance below the juncture of two small streams, the Clear Fork and the West Fork, the union of which forms the Trinity River. The drainage area above the city embraces 2,300 square miles. Reports from two points in the upper reaches of the drainage area warrant the belief that the torrential rains covered the whole drainage area, hence the unprecedented flood of April, 24–25, 1922.

It is desired to digress here to give data of former heavy rainfall and resulting floods. On September 20–21, 1900, local rainfall measured 7.44 inches within 24-hour period, resulting in flood waters reaching an estimated depth of 38 feet, but the rise was so gradual as to result in very little destruction other than still water effects.

On May 24–25, 1908, local rainfall measured 6.99 inches, occurring within 15 hours 13 minutes. River stage estimated from ripple marks on bridge showed 39 feet. But little loss of property and life resulted, owing to the slow rising of the waters, and the fact that there was daylight, too, prevented anyone being trapped by the flood.

The above-mentioned floods were of little moment to property or life, but the flood of April 24–25, 1922, had other factors not found in former floods. Levee protection, which was depended upon, was the outstanding element that militated against such protection. The river proper at the Government river-gage is 98 feet wide in channel. Back 100 feet from the channel a 10-foot-high levee was thrown up and grassed over. This levee gave a channel practically 298 feet wide, and 30 feet to river-bed level, supposedly allowing sufficient channel for any flood waters likely to occur. The test came the morning of the 25th. At 7 a. m. the river-gage showed 33.5 feet, being 3.5 feet above flood stage and

running over the levee. No one knows how long the water had been over the levee, for the rainstorm had been so intense and the electrical storm so terrific that it appears that no one had ventured out to note conditions.

The residential lowland district was under water before any one knew it, house pets giving first alarm by cries and scrambling for places of safety. People stepping out of bed found water ankle deep, and more, already in their homes, and the flood soon became waist deep. Ceilings were opened and refuge taken in lofts, and daylight found many people marooned on housetops awaiting rescue.

By 7:30 a. m. a crevasse was made in the levee some distance above the residential district, and the flood filled in rapidly, water running into residence windows by 10 a. m., and reaching the eaves of many homes by 2 p. m., when the flood crest stood highest of record at this station, 39.1 feet.

The lowland residential district embraces about 4 square miles, and about 1,500 inhabitants were subjected to overflow waters. After the levee broke many head of live stock drowned in their stalls, at hitching posts, in wire entanglements, in hobbles and lariated, while many head of other animals were washed away.

While there are but 11 known dead, many are missing and can not be accounted for by any reasoning other than that they have been drowned and buried in drift and river débris. Losses can only be estimated. The reckoning embraces losses within the city limits, probably reaching half a million dollars affecting live stock, municipal properties, and homes and home furnishings, while the item of clean-up expenses will run into thousands of dollars.

RAINFALL OF COLOMBIA, SOUTH AMERICA.

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[Weather Bureau, Washington, D. C., May 28, 1922.]

In this REVIEW **50**:146 announcement was made of the proposed establishment of a meteorological service in the Republic of Colombia. In view of the fact that exceedingly few series of meteorological observations are available for that country, it has seemed advisable at this time to make an inventory of such as are available and publish it in the interest of all concerned. As the title of this note suggests, rainfall only will be considered. Temperature observations are likewise very few in number, but the geographic position of Colombia, together with the known rate of decrease in temperature with altitude, make the deficiency in observational material less serious than in the case of precipitation.

Precipitation measurements varying in length from 1 to 10 years are available for but 10 stations, and 6 of these are along the Pacific Railroad from Buenaventura to Cali on the Cauca River, a distance of 108 miles. For these latter only the annual totals are available.

The rainfall of Colombia is almost wholly of the convective type and is clearly associated with the declination of the sun as the latter successively crosses parallels of latitude on its northward progress at the vernal equinox and on its return journey southward at the autumnal equinox. The rainy seasons, of which there are two in the zone between the Equator and say 8° north or south latitude, separated by relatively dry seasons, are coincident with the time of zenith sun at midday. The first wet season occurs in the months of April, May, and June and the second in September, October, and November. In latitudes more distant from the Equator the two wet and the two relatively dry seasons merge into a well-defined wet and dry season, respectively, of varying length and without sharp lines of demarkation between the two. On the Pacific coast of Colombia, however, rain falls almost daily and there is no dry season; in other localities there is considerable rain in the so-called dry season.

The annual totals in inches are presented for the 10 stations in Table 1.

TABLE 1.—*Annual rainfall in Colombia, South America (inches and hundredths).*

Years.	Buenaventura.[4]	San Jose.[4]	Caldas.[4]	Palmar.[4]	Lomitas.[4]	Yumbo.[4]	La Manuelata (Cauca Valley).[4]	Medellin.[5]	Bogata.[6]	Patomines[6] on Rio Neche.
Elevation (feet).	Sea-level.	600	2,560	(?)	.....	(?)	3,500	5,216?	8,612	.....
1849									74.40	.....
1881									54.25	.....
1882									35.97	.....
1883									39.35	.....
1900							39.97			.....
1901							45.21			.....
1902							33.80			.....
1903							56.38			.....
1904							37.74			.....
1905							33.79			.....
1906							39.96			.....
1907							47.80			.....
1908							54.94			.....
1909							55.13			.....
1910	323.96	270.00	57.08	34.06	.....	.....	48.50			.....
1911	248.66	277.37	46.66	25.41	33.34	.....	.....			.....
1912	265.10	400.88	54.56	.....	.....	.....	.....			.....
1913	234.90	296.10	50.11	.....	.....	37.73	.....			143.6
1914	262.86	.....	31.09	.....	.....	.....	.....			.....
1900–1910[3]	.....	.....	.....	.....	.....	.....	.....	62.83	.....	.....
1875–1879[2]	.....	.....	.....	.....	.....	.....	44.66	.....	.....	.....

[1] 11 months.
[2] 5-year mean
[3] 11-year mean.
[4] *Bul. Amer. Mus. Nat. His.* **36**: 79–83. The distribution of bird life in Colombia, Frank M. Chapman.
[5] *Met. Zeit.* **3**: 419.
[6] *Signal Service International Bulletin*, 1880–1884.

Remarks on Table 1.—Buenaventura is the sea-level terminus of the Pacific Railroad of Columbia; San Jose is distant therefrom 23 miles and in the region of heavy tropical rains. The station Caldas, 51 miles from the coast, is in a relatively arid pocket or basin shut off from the prevailing westerly winds by a mountain ridge which apparently robs the winds of their moisture. The stations Palmar and Lomitas are apparently on the Pacific slope; the details are missing, however, and the reason for the relatively small rainfall is not known.